Applicants acknowledge, with thanks, the Examiner's indication that Claims 21-22 are allowable over the art of record. Although allowance of Claims 21-22 is indicated, applicants, at the present time, would like to obtain a patent including all the claims pending in the present application.

Claims 1-20 stand rejected under 35 U.S.C. §103(a) as allegedly obvious over U.S. Patent No. 6,228,678 to Gilleo, et al. ("Gilleo, et al.") in view of U.S. Patent No. 6,372,544 to Halderman, et al. ("Halderman, et al."). Applicants' respectfully traverse the §103 rejection and submit the following.

Applicants submit that the claims of the present invention are not rendered obvious by the disclosures of the applied references because the applied references fail to teach or suggest all of the claimed limitations of applicants' method. Specifically, the applied references fail to teach or suggest, "*forming a second polymeric material that is partially cured over said first polymeric material and said conductive bump material*", as recited in amended Claim 1. "To establish a prima facie case of obviousness of a claimed invention all the claimed limitations must be taught or suggested by the prior art". In re Wilson, 424 F.2d 1382, 1385, 165 USPQ 44, 496 (CCPA 1970).

Applicants submit that Claim 1 is not made obvious by the disclosure of Gilleo, et al., since the applied reference does not teach or suggest applicants' claimed method. The primary reference Gilleo, et al. does not teach or suggest "*forming a second polymeric material that is partially cured over said first polymeric material and said conductive bump material*". Applicants note, referring to Page 5 of the instant Office Action, that the Examiner agrees that,

"Gilleo fails to teach a partially cured second polymeric material over a first polymeric material and conductive bump material".

Halderman, et al., do not alleviate the deficiency of Gilleo, et al. since Halderman, et al. do not teach or suggest applicants' claimed method. Specifically, Halderman, et al. do not teach or suggest forming a bilayer underfill, "comprising the steps of forming a first polymeric material on a surface of a semiconductor wafer having interconnect pads disposed thereon; patterning said first polymeric to provide openings that expose said interconnect pads; forming conductive bump material in said openings; *forming a second polymeric material that is partially cured over said first polymeric material and said conductive bump* material; dicing said semiconductor wafer into individual chips; and bonding at least one of said individual chips to an external substrate, wherein during such bonding said conductive bump material penetrates said second polymeric material and contacts a surface of said external substrate", as recited in amended Claim 1.

Applicants submit that Halderman, et al. is substantially removed from applicants' claimed method. Halderman, et al. disclose a method of reducing the incidence of cracking of the underfill material and solder balls by softening the underfill material. More specifically, Halderman, et al., referring to Column 2, lines 23-29, disclose, "a polymeric bonding underfill material disposed between the semiconductor die, and the polymeric bonding material further disposed along the edges of the semiconductor die forming a fillet of underfill material surrounding the edges of the semiconductor die, wherein the fillet is made substantially compliant so as to reduce occurrences of crackings in the underfill material."

Applicants submit that Halderman, et al. fail to teach or suggest a second polymeric layer that is partially cured atop a first polymeric material and conductive bump material.

Halderman, et al. only disclose a single layer of polymeric material. Therefore, Halderman, et al. fail to teach or suggest a second polymeric layer, let alone a second polymeric material that is partically cured. Halderman, et al. also fail to teach or suggest bonding of individual chips to an external substrate, wherein during such bonding the conductive bump material penetrates the second polymeric material and contacts a surface of said external substrate as recited in amended Claim 1. Halderman, et al. fail to teach or suggest every limitation of applicants' claimed method.

Applicants further submit that the Halderman, et al. teach away from applicants' claimed method. Halderman, et al. teach away from partially curing the second polymeric layer, as recited in amended Claim 1. Halderman, et al., referring to Column 3 lines 58-62, disclose that, "the treatment with an appropriate solvent chemically breaks the cross-linked molecules, generally referred to as the cross-links, and essentially uncures the polymeric underfill material". Hence, Halderman, et al. teach a hard, fully cured segment 42 and a soft, uncured segment 40. There is no teaching or suggestion of a partially cured segment in Halderman, et al.

The §103 rejection also fails because there is no motivation in the applied references which suggests modifying the methods disclosed therein to include applicants' claimed method which includes forming a bilayer underfill layer by forming, "a first polymeric material on a surface of a semiconductor wafer having interconnect pads disposed thereon; patterning said first polymeric layer to provide openings that expose said interconnect pads; forming conductive bump material in said openings; *forming a second polymeric material that is partially cured over said first polymeric material and said conductive bump* material; dicing said semiconductor wafer into individual chips; and bonding at least one of said individual

chips to an external substrate, wherein during such bonding said conductive bump material penetrates said second polymeric material and contacts a surface of said external substrate".

In contrast, the applied references do not teach or suggest a partially cured second polymeric layer deposited atop the first polymeric layer. This rejection is thus improper since the prior art does not suggest this drastic modification. The law requires that a prior art reference provide some teaching, suggestion, or motivation to make the modification obvious.

Here, there is no motivation provided in the disclosures of the applied prior art references, or otherwise of record, which would lead one skilled in the art to modify the methods of the applied references to include applicants' claimed sequence of processing steps recited in amended Claim 1 that lead to the formation of microelectronic interconnect structure containing a bilayer underfill layer. "The mere fact that the prior art may be modified in the manner suggested by the Examiner does not make the modification obvious unless the prior art suggested the desirability of the modification." In re Fritch, 972 F.2d, 1260,1266, 23 USPQ 1780,1783-84 (Fed. Cir. 1992).

Additionally, there is no motivation to combine Halderman, et al. and Gilleo, et al. because combining the references renders the prior art references unsatisfactory for their intended purposes. It is the Examiner's position, referring to Page 5 of the instant Office Action, that "it would have been obvious for one of ordinary skill in the art of making semiconductor devices to incorporate Halderman's teaching into Gilleo's method to partially cure the second polymeric material in order to harden the polymeric material." The Examiner specifically notes Claim 10 of the Halderman, et al. reference where, "hardening comprises curing the polymeric material thereby forming cross-links".

Halderman, et al. incorporate cross-linking (thermosetting) polymers as underfill. See Column 3 lines 50-62. Thermosetting polymers cross-link and do not soften and flow when heated. In fact, thermosetting polymers become permanently hard when heat is applied to them due to cross-linking. Halderman, et al. are directed at softening a portion of the thermoset polymers by breaking the cross-links via chemical reaction or excessive thermal heating. Gilleo, et al. incorporate thermoplastic or very low cross-linked polymers in order to allow for reworking of the chip during the mounting step. See Column 7 lines 29-31. Thermoplastics are plastics that do not cross-link and soften and flow when heated. Gilleo, et al. eliminate the problems associated with thermoset underfills by incorporating, a thermoplastic resign as the main component of the underfill. See id.

One of ordinary skill in the art would not be motivated to combine the disclosure of Halderman, et al., concerning breaking cross-linked molecules in thermosets, with the disclosure of Gilleo, et al., disclosing thermoplastics that do not incorporate cross-linked molecules. The method of Halderman, et al. would not perform its' intended purpose when utilized with thermoplastic structures that do not include cross-linked molecules and therefore there is no motivation to combine Gilleo, et al. with Halderman, et al. to create the applicants' claimed method recited in amended Claim 1. If proposed modification would render the prior art invention being modified unsatisfactory for its' intended purpose, than there is no suggestion or motivation to make the proposed modification. In re Gordon, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984).

Based on the above amendments and remarks, the §103 rejections have been obviated; therefore reconsideration and withdrawal of the instant rejections are respectfully requested.

In summary, applicants respectfully submit that this application is in condition for allowance. Accordingly, applicants respectfully request that this application be allowed and a Notice of Allowance be issued. If the Examiner believes that a telephone conference with the applicants' representatives would be advantageous to the disposition of this case, the applicants request that the Examiner telephone the undersigned.

Respectfully submitted,

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